

# Novel, Regenerable Microlith Catalytic Reactor for CO<sub>2</sub> Reduction via Bosch Process, Phase I

Completed Technology Project (2011 - 2011)



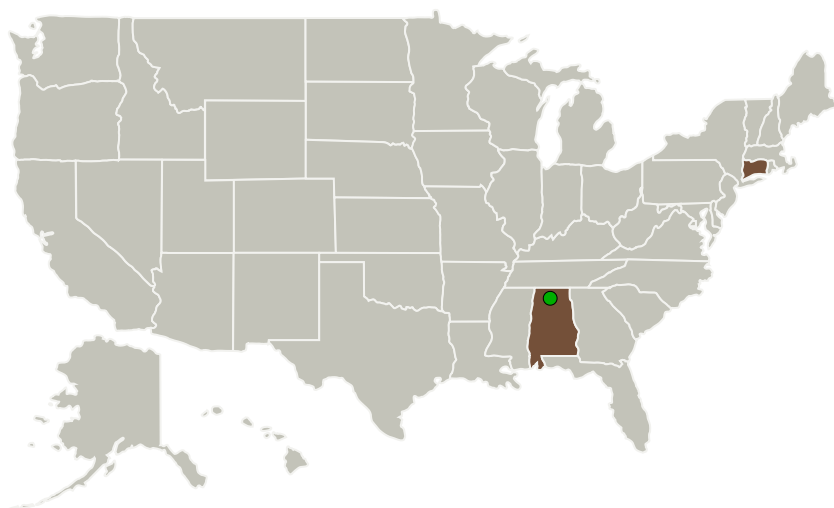
## Project Introduction

Precision Combustion, Inc. (PCI) proposes to develop an extremely compact, lightweight and regenerable Microlith

REG

catalytic CO<sub>2</sub> reduction reactor, capable of converting mixtures of CO<sub>2</sub> and H<sub>2</sub> to carbon and water vapor with high CO<sub>2</sub> conversions at high throughputs and at low operating temperatures. This is based on a novel catalytic reactor approach with high heat and mass transfer, high conversion efficiency, narrow temperature distribution, and novel approaches to carbon removal. The utilization of carbon dioxide to produce life support consumables, such as O<sub>2</sub> and H<sub>2</sub>O, via Bosch reaction offers a potential advance for NASA's cabin atmosphere revitalization system (ARS) and in-situ resource utilization (ISRU) concepts for long-term manned space missions. Current Bosch reactor designs suffer from a large recycle penalty due to slow reaction rates and the inherent limitation in approaching thermodynamic equilibrium, plus significant challenge in carbon removal. PCI's short contact time catalysts offer the potential for faster reaction rates, higher conversions and a reduced need for recycle. In addition, strategies will be explored for more effective mechanical and chemical approaches to carbon removal and catalyst regeneration. The approach offers a potential for an ultra-compact Bosch reactor with improved effectiveness and robustness, with lower pressure drop and power requirement.

## Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Precision Combustion, Inc.	Lead Organization	Industry	North Haven, Connecticut
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Connecticut

## Project Transitions

**February 2011:** Project Start**September 2011:** Closed out

### Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138384>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Precision Combustion, Inc.

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Principal Investigator:

Saurabh Vilekar

### Co-Investigator:

Saurabh Vilekar

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## Technology Maturity (TRL)

Start: **2**  
Current: **3**  
Estimated End: **3**



## Technology Areas

### Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - └ TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - └ TX06.1.1 Atmosphere Revitalization

## Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System